Mechanical R&D at Argonne

Focus on TASD Design

Half-height mechanical prototype

- not instrumented-

- TASD: alternate layers of horizontal and vertical extrusions
  - Off-the shelf commercial extrusions purchased by ANL for $7k
- Prototype: 4-layers deep
- Extrusions will be sealed at both ends
- Extrusions will be filled with water

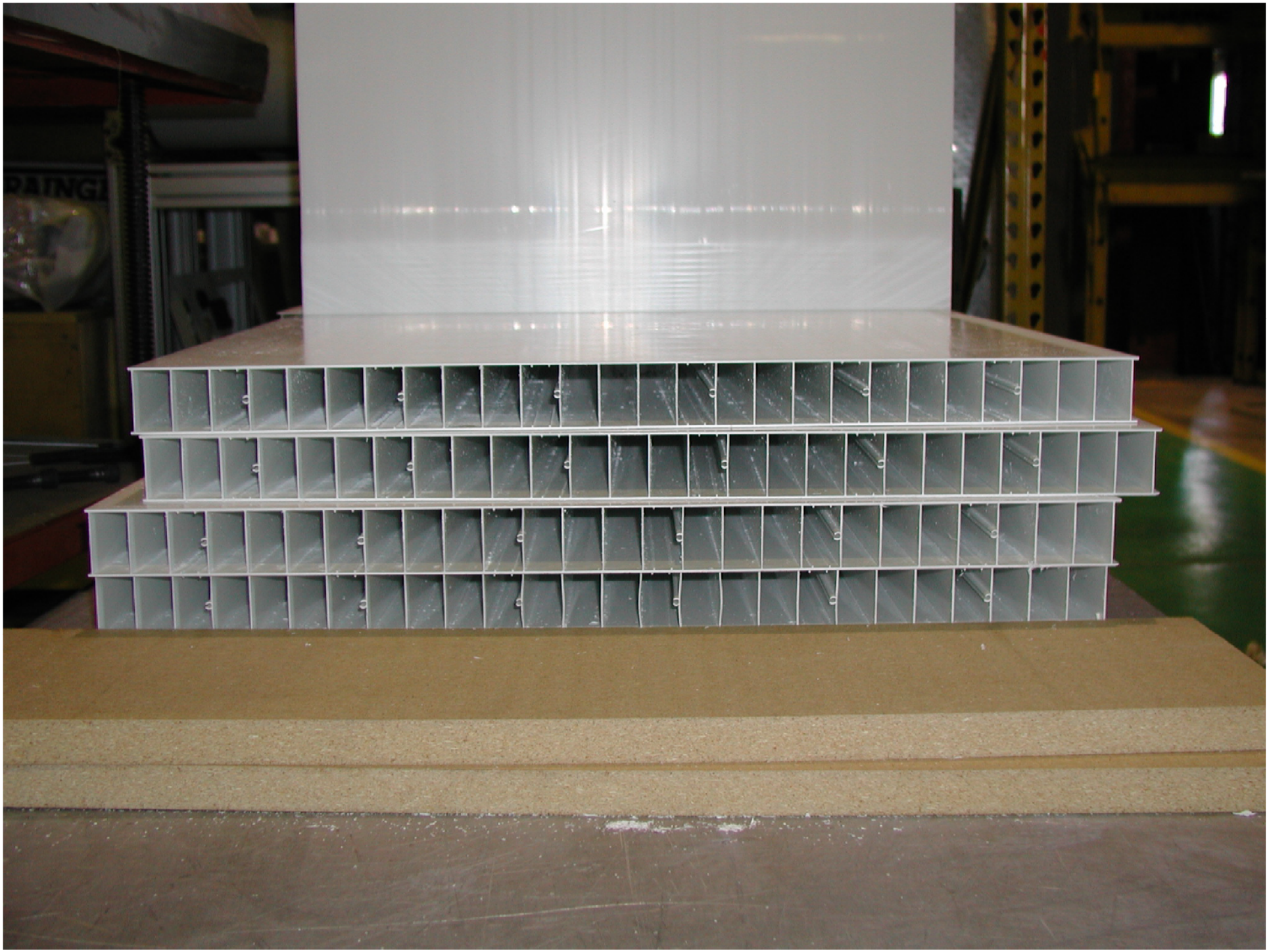
- Goals
  - Complete the structure in December ‘04
    - Test assembly process
  - Test structural properties of prototype Jan-March’05
- Plans beyond March
  - Several possibilities

PVC Extrusions

- ANL purchased commercial extrusions from
  - Extrutech in Manitowoc, Wi
    - 34 cells (34” wide), 27 ft long
- Compare to NOvA Design

	ANL Prototype	TASD	Baseline
Height	8 m	17 m	14.5 m
Inner-wall thickness	0.8 mm	1.0 mm	1.0 mm
Outer-wall thickness	1.6 mm	2.0 mm	1.5 mm
Cell dimensions	2.5 x 4.1 cm^2	3.9 x 4.5 cm^2	2.5 x 4.0 cm^2
Cell cross section	10 cm^2	17 cm^2	10cm^2
TiO_2 content	8%	10-15%	10-15%


WAKEFIELD
ACCELERATOR



Half-Height Prototype

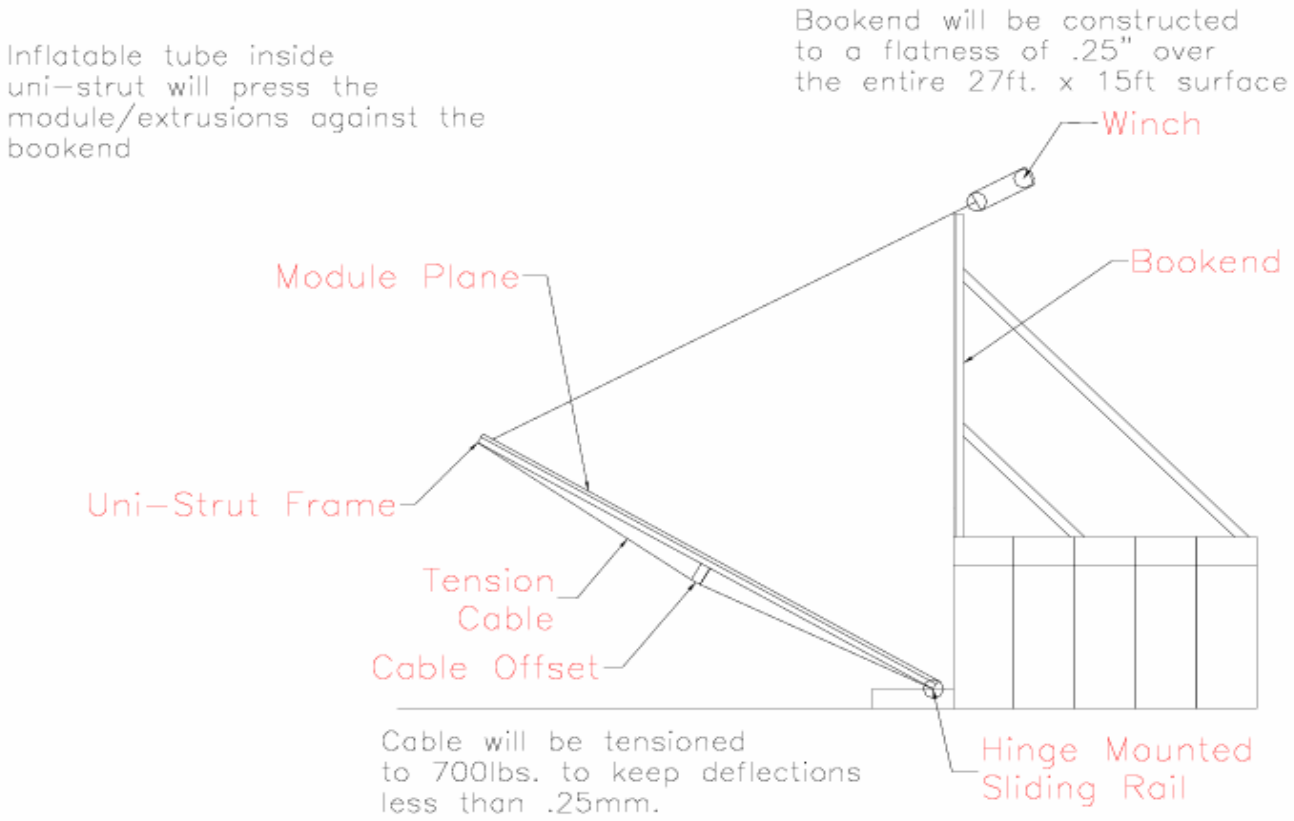
- Four Planes (2 X and 2 Y)
  - 27 ft (8m) high x 15 ft (4.5m) wide
- Planes assembled at floor level, horizontally
  - Assembly takes place on lifting fixture
- Planes are rotated up and secured against a book-end


TORNADO
SHELTER


TORNADO SHELTER
EXIT
TORNADO SHELTER

Bookend and Lifting Fixture

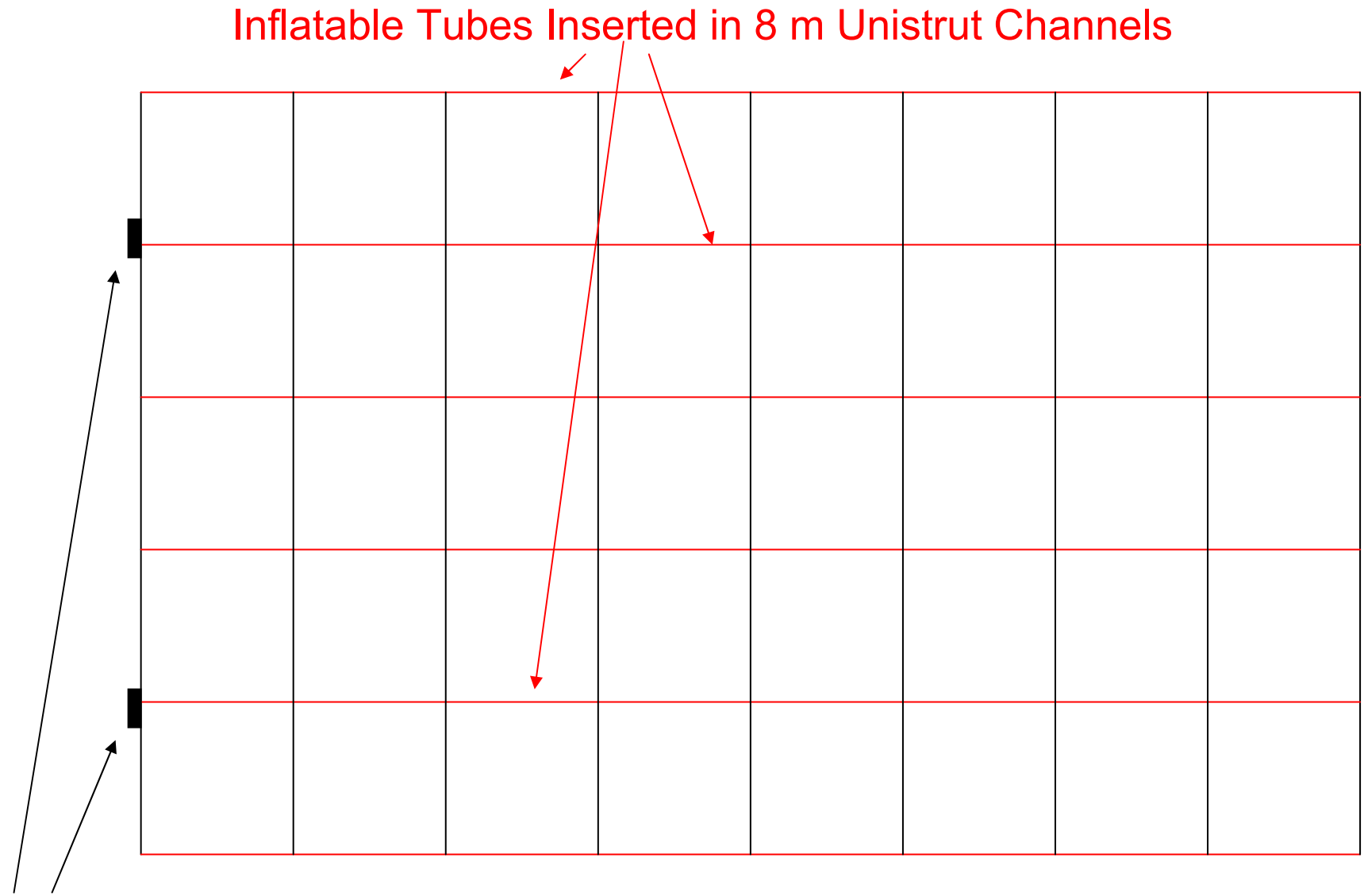
Side View



Plane Assembly

- Extrusions
  - Attach end plugs and manifolds
    - end plugs and “crude” manifolds made at FNAL
    - Contain water and sustain pressure tests
- Assemble a “bi-plane” on the floor
  - 5 Y modules (27 ft long)
  - 9 X modules (15 ft long)
  - “Glue” extrusions together

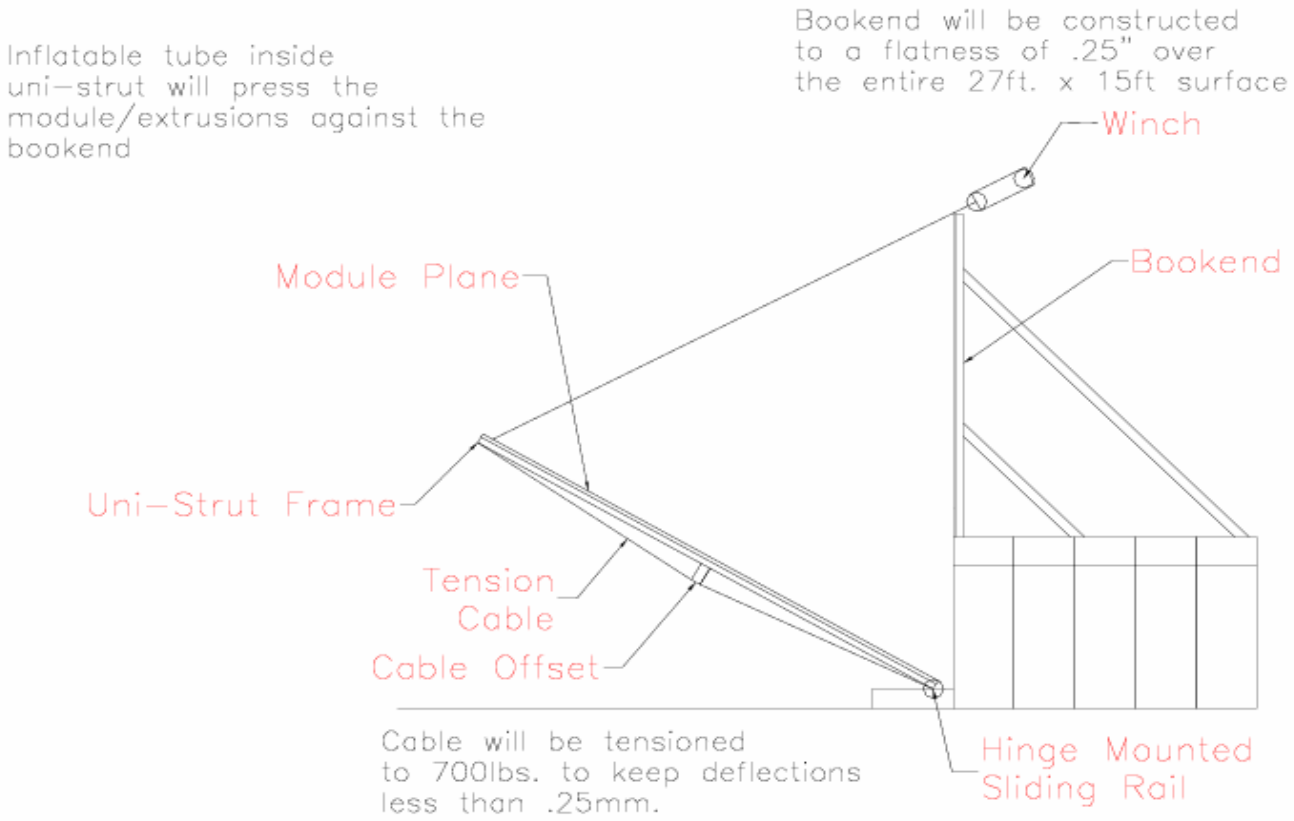
Lifting Fixture: Artist's Conception



Attach Layers to Book-end

- Spread “glue” over top bi-layer
- Rotate lifting fixture to the vertical
  - Special lifting fixture holds bi-plane **flat** against bookend: inflatable tubing
- Allow some (short) time to cure
- Rotate lifting fixture down to the floor
- Assemble another bi-plane
- Repeat the attachment procedure

Bookend and Lifting Fixture
A Side View



The Assembly Process

What will we learn?

- Go beyond paper studies of assembly method
  - Already eliminated “piece-by-piece” method on paper
- Gain practical experience and new insights
  - Optimize assembly procedure
  - Relate this experience to other assembly methods
- Is this method of assembly practical?
  - Bi-plane assembly
    - Flatness
    - Time
  - Lifting fixture with hydraulic pressure
    - Flat enough?
    - Turnaround time
  - Labor
- Will this method work for a full-scale detector?

Mechanical Tests of Half-height Prototype

- Answer these kinds of questions
  - Is the structure stable?
  - How much support does it need?
  - Is there creep?
- Tests: After 4 layers are secured vertically
  - Fill extrusions with water
    - Define the procedure: for example, liquid level is ~same in all extrusions
  - All extrusions can be drained and re-filled for further testing
- Strain gauges will be located in strategic locations
- Seal air vents and pressurize extrusions to simulate hydraulic pressure (in verticals) of full-scale detector

Possibilities for future prototype work

- Some current suggestions are
  - Build an additional 10-20 layers
    - Optimize assembly methods
    - Test extended prototype for stability when filled with water
  - Insert fibers into some of the extrusions?
    - Tests of manifold/fiber optics system
  - Fill some extrusions with scintillator?.....
- We are open to ideas from the collaboration